

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**

PCTWORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : A21D 8/00, 15/00, 15/08	A1	(11) International Publication Number: WO 91/19421 (43) International Publication Date: 26 December 1991 (26.12.91)
(21) International Application Number: PCT/US90/03407 (22) International Filing Date: 15 June 1990 (15.06.90) (60) Parent Application or Grant (63) Related by Continuation US 366,902 (CIP) Filed on 15 June 1989 (15.06.89) (71) Applicant (for all designated States except US): KRAFT GENERAL FOODS, INC. [US/US]; 250 North Street, White Plains, NY 10625 (US). (72) Inventors; and (75) Inventors/Applicants (for US only) : MURPHY, Gregory, B. [US/US]; Lighthouse Road, Sands Point, NY 11050 (US). LANG, Kevin, W. [US/US]; 1 Tulip Drive, Lloyd Neck, NY 11743 (US). FRAKE, Barry, N. [US/US]; 1 Gull Cove, Northport, NY 11768 (US). ENTENMANN, William, J. [US/US]; 26 Beech Road, Islip, NY 11751 (US).		(74) Agent: SAVOIE, Thomas, R.; 2665 Gregory Street, Yorktown Heights, NY 10598 (US). (81) Designated States: AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH (European patent), CM (OAPI patent), DE (European patent)*, DK (European patent), ES (European patent), FI, FR (European patent), GA (OAPI patent), GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL (European patent), NO, RO, SD, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US. Published <i>With international search report.</i>
(54) Title: PROCESS FOR BAKED GOODS AND PRODUCTS THEREFROM (57) Abstract Doughs and batters are prepared which contain hydrated polysaccharide hydrocolloid and hydrated insoluble fiber and/or hydrated protein preferably at a weight ratio of 1:0.8-6:1.1-4.5. Preferably the hydrated materials are added to the dough or batter formulation as an aqueous dispersion. The resulting dough and batter can be baked in a conventional manner. This invention is particularly useful in the preparation of fat-free baked goods.		

DESIGNATIONS OF "DE"

Until further notice, any designation of "DE" in any international application whose international filing date is prior to October 3, 1990, shall have effect in the territory of the Federal Republic of Germany with the exception of the territory of the former German Democratic Republic.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MG	Madagascar
AU	Australia	FI	Finland	ML	Mali
BB	Barbados	FR	France	MN	Mongolia
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Faso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GN	Guinea	NL	Netherlands
BJ	Benin	GR	Greece	NO	Norway
BR	Brazil	HU	Hungary	PL	Poland
CA	Canada	IT	Italy	RO	Romania
CF	Central African Republic	JP	Japan	SD	Sudan
CG	Congo	KP	Democratic People's Republic of Korea	SE	Sweden
CH	Switzerland	KR	Republic of Korea	SN	Senegal
CI	Côte d'Ivoire	LI	Liechtenstein	SU	Soviet Union
CM	Cameroon	LK	Sri Lanka	TD	Chad
CS	Czechoslovakia	LU	Luxembourg	TC	Togo
DE	Germany	MC	Monaco	US	United States of America
DK	Denmark				

- 1 -

1 PROCESS FOR BAKED GOODS AND PRODUCTS THEREFROM

2

3 TECHNICAL FIELD

4 Our invention relates to the production of doughs and
5 batters for producing baked goods, particularly
6 reduced-fat and fat-free baked goods having a shelf-life,
7 softness, and acceptance comparable to their full-fat
8 counterparts. Our invention can also find utility for
9 producing fat-containing baked goods which have improved
10 shelf-life.

11 While it may be possible to merely remove or lower
12 the fat component of some baked goods and still obtain an
13 edible product from the oven, these fat-free or
14 reduced-fat baked goods tend to rapidly stale and are of
15 little commercial use. Also, removing or reducing the
16 fat from baked goods formulations may change the
17 properties of the dough or batter such that normal bakery
18 processing is made difficult. Thus,
19 commercially-acceptable ways to reduce or eliminate fat
20 from baked goods are much sought after. Also, techniques
21 to improve the shelf-life of conventional, full-fat baked
22 goods is a much sought after goal.

23

24 BACKGROUND ART

25 Many prior art disclosures recite the incorporation
26 of materials such as gums, cellulosic fiber or protein
27 into batter and dough formulations. These teachings,

1 however, have not enabled the production of high-quality,
2 no-fat or reduced-fat baked goods which have been widely
3 accepted in the marketplace. Among such prior art
4 patents are: U.S. Patents 3,234,027 to Jertson et al.;
5 3,574,634 to Singer; 4,109,018 to Thompson; 4,143,163 to
6 Hutchinson et al.; 4,198,438 to Singer et al.; 4,219,580
7 to Torres; 4,424,237 to Wittman; 4,431,681 to Hegedus
8 et al.; 4,451,490 to Silverman et al.; 4,503,083 to
9 Glicksman et al.; 4,774,009 to Feeney et al.; 4,824,683
10 to Hodgson et al.; and published EPO application 340,035
11 and published PCT application 89/01813 both to Chen et al.
12

13 DISCLOSURE OF THE INVENTION

14 The present invention is directed to the use of
15 hydrated, polysaccharide hydrocolloids, either alone or
16 in combination with hydrated insoluble fiber and/or
17 protein material, in wheat flour-containing doughs and
18 batters in order to improve the functional and/or
19 organoleptic attributes of baked goods produced from such
20 doughs and batters. Baked goods which incorporate the
21 teachings of this invention have been found to have
22 improved texture, mouthfeel, softness, moistness,
23 moisture-retention, shelf-life, flavor-enhancement, fatty
24 attributes and/or volume.

25 The use of hydrated, polysaccharide hydrocolloids,
26 together with, as desired, hydrated insoluble fiber and
27 hydrated protein material, as taught in this invention,
28 will find utility in a wide variety of baked goods,
29 particularly where it is important or desired to
30 eliminate or reduce fat content, to prevent or control
31 moisture migration, to preserve moisture-related softness
32 and/or mouthfeel, or to impart lubricity to the mouthfeel
33 of the product. It is believed that the hydrated,
34 polysaccharide hydrocolloids, with or without added
35 insoluble fiber and/or protein material, function, in

1 part, as an efficient water binder and is able to retain
2 increased levels of moisture in the baked good without
3 substantially increasing the water activity of the baked
4 good.

5 It is speculated that the hydrated, polysaccharide
6 hydrocolloids, with or without added insoluble fiber
7 and/or protein is able to function as a reservoir of
8 bound moisture which is able to slowly release this
9 moisture into the baked good as moisture is passed from
10 the baked good to the ambient atmosphere. It is also
11 speculated that the fiber component disrupts or otherwise
12 reduces any gummy texture which could result from the
13 presence of the polysaccharide hydrocolloids. Baked
14 goods prepared in accordance with this invention will
15 usually have an initial moisture content which is
16 greater, typically at least 3% greater, than their
17 conventional counterparts. This moisture differential
18 should increase over time during normal storage and
19 distribution of the products, as the baked goods of this
20 invention appear to lose moisture at a slower rate than
21 their conventional counterparts.

22 The polysaccharide hydrocolloids are incorporated
23 into the dough or batter composition in a hydrated state,
24 preferably as a preformed, aqueous dispersion. The
25 addition of unhydrated polysaccharide hydrocolloids
26 directly to conventional dough or batter processes does
27 not provide enough water and/or enough time to permit
28 adequate hydration of the hydrocolloids, as materials
29 such as flour and sugars absorb large amounts of water
30 before the polysaccharide hydrocolloids are hydrated.
31 When added in the form of an aqueous dispersion, the
32 dispersion should have a thick, paste-like consistency
33 and a viscosity of at least 4, preferably at least 6 and
34 most preferably at least 8, as measured at 40°F using a
35 Brookfield Model HAT Viscometer with a helipath stand and

1 a size-D, T-Bar spindle at 5 RPMs (scale 0-100). The
2 aqueous dispersion should also have a solids content,
3 basis the amount of polysaccharide hydrocolloid,
4 insoluble fiber, protein and water components present in
5 the dispersion, of from 2 to 35% by weight, preferably
6 from 5 to 30% and most preferably from 9 to 25%. The
7 solids content of the dispersion will be adjusted based
8 primarily on obtaining a viscosity which is easy to
9 handle and incorporate into the dough or batter, as well
10 as the amount of water which may be tolerated in the
11 dough or batter and the nature of the desired baked good.

12 The polysaccharide hydrocolloids used in this
13 invention are preferably water-soluble, non-gelling gums,
14 such as xanthan, guar, CMC (carboxymethyl cellulose) and
15 the like. Gums which form gels, such as alginates,
16 pectin, kappa and iota carrageenan and the like are not
17 preferred for use in this invention. Non-polysaccharide
18 hydrocolloids, such as gelatin, have not been found to be
19 suitable for use in this invention.

20 A combination of an anionic polysaccharide
21 hydrocolloid and a galactomannan polysaccharide
22 hydrocolloid has been found to be preferred for use in
23 this invention. The anionic polysaccharide will
24 preferably include within its molecular structure
25 dependent carboxylic acid groups. Xanthan gum and
26 carboxymethyl cellulose are such polysaccharides.
27 Galactomannans are polysaccharides composed of mannose
28 and galactose. Guar gum, a galactomannan which has a
29 mannose-to-galactose ratio of about 1.8:1, has proven to
30 be well-suited for use in this invention.

31 Combinations of xanthan gum and guar gum at a weight
32 ratio of 1:4 to 4:1, preferably 1:3 to 3:1 and most
33 preferably about 1:1, have been found to be highly
34 preferred for use in this invention. Xanthan gum is a
35 high molecular weight polysaccharide which is obtained by

1 pure culture fermentation of glucose with a bacterium of
2 the genus Xanthamonas, such as Xanthomonas campestris.
3 Xanthan is a heteropolysaccharide made up of building
4 blocks of D-glucose, D-mannose and D-glucuronic acid.
5 Guar gum is isolated from the seeds of the guar bean
6 (Cyamopsis Tetragonolobas L. taub.) which is native to
7 India and Pakistan.

8 As utilized in this invention, the insoluble fiber
9 will also be incorporated into the dough or batter
10 composition in a hydrated state in a manner comparable to
11 the addition of the hydrated, polysaccharides
12 hydrocolloids. Thus, typically, the hydrated, insoluble
13 fiber will be added in the preformed aqueous dispersion
14 which contains the hydrated, polysaccharide
15 hydrocolloids. The insoluble fiber which may be employed
16 in this invention can be any edible fiber material,
17 including powdered cellulose (at least 95% insoluble
18 fiber). Fiber derived from cereal grains (e.g., oat,
19 wheat, corn, soy, etc.) is well-suited for use in this
20 invention. Oat fiber, which contains a relatively-high
21 level (at least 85%) of insoluble fiber, soy fiber and
22 wheat fiber have been successfully used in the practice
23 of this invention. The particles of fiber in the aqueous
24 dispersions of this invention may have an average
25 particle size of between about 10 and 200 microns,
26 preferably between 10 and 100 microns. The size of the
27 fiber particles will be a function of the particle size
28 of the selected raw material and the amount of fiber
29 particle fracture resulting from the mixing and/or
30 homogenization employed to produce any aqueous dispersion.

31 The protein material which can be used in this
32 invention may be an essentially-pure protein, as in the
33 case of whey protein or casein, or as part of a protein
34 containing material, such as dry non-fat milk solids,
35 dried egg whites, soy protein, wheat protein, wheat

1 gluten, etc. Non-fat milk solids (about 36% protein) and
2 wheat gluten have been found to be particularly useful in
3 this invention. Proteins, such as casein, which form
4 protein micelles in an aqueous dispersion should also be
5 suitable for use in this invention. The protein may be
6 at least partially denatured as denatured protein has
7 higher water absorption properties than undenatured
8 protein. For purposes of this invention, the protein
9 material, as previously noted for the hydrocolloid and
10 fiber materials, is in a hydrated state as it is
11 incorporated into the dough or batter.

12 If an aqueous dispersion is used in the practice of
13 this invention, the dispersion may contain additional
14 ingredients such as dispersing agents (e.g. sugars and/or
15 maltodextrin), free-flow agents, preservative systems
16 (e.g. potassium sorbate), flavor systems and coloring
17 agents. Emulsifiers are not needed in the aqueous
18 dispersions of this invention; however, if included,
19 emulsifiers would be present at a level below that of the
20 polysaccharide hydrocolloids. The pH of the dispersion
21 should be maintained above about 5.0 in order to avoid
22 adverse effects upon any protein component. In any
23 dispersion produced, according to this invention, the
24 components of the aqueous dispersion do not form a
25 complex. Although not preferred, the components could be
26 hydrated separately and three dispersions added to the
27 batter or dough formulation. The materials of this
28 invention are thus unlike the gum-protein complexes
29 described in the aforementioned Chen et al. disclosures.

30 This invention has been found to be useful in the
31 production of baked goods, such as, but not limited to,
32 bread-type products (e.g., breads, rolls and bagels),
33 sweet goods, pastries, danish, doughnuts, cakes, cookies
34 and the like. It may be desirable to modify existing
35 dough or batter formulations and processes in order to

1 optimize the use of our invention, but this can be done
2 on a product-by-product basis, as desired, by skilled
3 bakers.

4 It would also be possible to dry, such as by freeze
5 drying, any hydrocolloid-containing dispersions desired
6 for use according to this invention. This dried material
7 could then be hydrated prior to being incorporated into a
8 dough or batter formulation.

9 All percents and ratios used throughout this
10 disclosure are by weight and based on the dry weight of
11 any hydrated hydrocolloid polysaccharide, insoluble fiber
12 and/or protein. Thus, if a fiber material contains both
13 soluble and insoluble constituents, only the weight of
14 insoluble fiber is considered. Likewise, if a protein
15 material, such as milk solids or vegetable protein
16 concentrates, contain non-protein components, only the
17 weight of the protein is considered. It should be noted
18 that any polysaccharide hydrocolloid, insoluble fiber or
19 protein material which is merely added in a conventional
20 manner to a dough or batter formulation in an unhydrated
21 state is not a component which is considered to be
22 hydrated according to the terms of this invention. It
23 is, however, specifically contemplated that this
24 invention can be utilized in batter and dough
25 formulations which do include added, unhydrated
26 polysaccharide hydrocolloids, insoluble fiber and/or
27 protein materials.

28 This invention is particularly useful in the
29 formulation of fat-free or reduced fat baked goods. The
30 lubricity, softness and/or moistness normally provided to
31 baked goods by fatty material, such as vegetable
32 shortening, appears to also be provided by the hydrated,
33 polysaccharide hydrocolloid materials disclosed herein.
34 According to another embodiment of this invention, the
35 softness and/or moistness of conventional, fat-containing

1 baked goods may be increased or extended by addition of
2 hydrated polysaccharide hydrocolloids to the dough or
3 batter formulation.

4 According to the fat-free or reduced-fat embodiments
5 of this invention, hydrated polysaccharide hydrocolloids
6 may be used in place of fat at a rate of about one part
7 hydrocolloid for each 40 to 60 parts of fat. Preferably
8 aqueous dispersions are prepared so that the use of the
9 dispersion for fat will be at a ratio of 0.5-1.5:1,
10 typically about 1:1.

11 As used herein, fat-free or substantially fat-free is
12 meant that the dough or batter is free of overtly added
13 fat materials, such as shortening. Low amounts of fat
14 that would naturally be present from other ingredients,
15 such as flour, or glyceride materials, such as
16 monoglycerides, which could be present in the dough or
17 batter as emulsifiers and/or dough conditioners are not
18 to be excluded by the term fat-free. Baked goods which
19 have a fat content of less than 0.5 grams per serving are
20 considered to be included in the term "fat-free".

21 According to this invention, for products other than
22 high fiber breads, the hydrated polysaccharide
23 hydrocolloids are included in dough or batter
24 formulations at a level of from 0.1 to 4.0, preferably
25 0.25 to 2.0, parts per 100 parts of flour. According to
26 a preferred embodiment of this invention, hydrated
27 insoluble fiber is also present in the dough or batter at
28 a level of 0.1 to 5.0, preferably 0.1 to 2.0, per
29 100 parts of flour. The ratio of polysaccharide
30 hydrocolloid to insoluble fiber should be from 1:0.8-3.5
31 in the case of cakes, pastry, danish, sweet doughs,
32 cookies and the like; however, for producing low-calorie,
33 high-fiber bread products it may be desired to employ a
34 higher ratio of fiber such as 1:3.0-6.0.

1 It should be noted that caloric reduction which
2 results from the practice of this invention can arise
3 from the reduction of the fat level in baked goods and
4 not replacement of flour by fiber and/or hydrocolloid. A
5 fiber level of less than 5% by weight of the flour
6 contained in the baked good is suitable for use in the
7 aqueous dispersions of this invention. This fiber level
8 is quite unlike the high-fiber, low-caloric breads known
9 in the art.

10 The addition of hydrated protein material to the
11 dough or batter formulations and baked goods of this
12 invention is thought to be desirable. Hydrated protein
13 should be included at a level of at least 0.1 parts per
14 100 parts of flour. In instances where protein is
15 contained in an aqueous, polysaccharide hydrocolloid
16 dispersion, it will be desirable that the ratio of
17 hydrocolloid to protein in the dispersion be from
18 1:1.1-4.5 and that the aqueous dispersion be added to a
19 flour or batter formulation such that the protein in the
20 dispersion amounts to 0.1 to 8 parts per 100 parts
21 flour. The protein content of the flour contemplated for
22 use in this invention are within the conventional range
23 of about 7 to 14% with the lower protein flours preferred
24 for cakes and the higher protein flours preferred for
25 breads.

26 A benefit derived from the use of a prepared aqueous
27 dispersion is that any of the materials contained therein
28 can be hydrated at a location or time remote from the
29 production of the dough or batter. In this manner
30 existing bakery processes do not have to be modified.

31 According to a specific embodiment of this invention,
32 aqueous dispersions are prepared which contain
33 polysaccharide hydrocolloid, insoluble fiber and protein
34 at a weight ratio of 1:0.8-6.0:1.1-4.5, preferably
35 1:0.8-3.5:1.5-3.5 and most preferably 1:1.5-2.0:2.0-3.0.

1 The process for preparing the aqueous dispersion may
2 be any technique which both hydrates the ingredients and
3 produces a uniform distribution of solids within a stable
4 aqueous dispersion. The process may be accomplished in a
5 one, two or more step operation. Most typically,
6 however, a procedure is followed in which the dry
7 ingredients are first combined in a batch-type mixer and
8 the resulting mix is passed through a mixing unit which
9 will produce a uniform aqueous dispersion, such as a
10 homogenizer or a continuous mixer. Thereafter, the
11 dispersion should be pasteurized such as by heating to
12 above about 160°F for up to ten minutes. The dispersion
13 is preferably maintained at 40°F (4.4°C) or below in
14 order to ensure microbial stability. Cooling of the
15 dispersion below 45°F (7.2°C) prior to use in a dough or
16 batter is thought to be desirable even in the event the
17 dispersion is utilized immediately after production.

18

19

EXAMPLE 1

20 A series of loaf cakes were prepared using the
21 following batter formulation:

22

23	<u>Ingredient</u>	<u>Parts (by weight)</u>
24	Water	15.47
25	Frozen Egg Whites	18.36
26	Emulsifiers	0.89
27	Flavor/Color	1.08
28	Sucrose	28.67
29	Flour	23.60
30	Nonfat Dry Milk	2.62
31	Salt	0.26
32	Preservative	0.11
33	Instant Starch	1.53
34	Leavening Acid	0.41

1	Baking Soda	0.41
2	Added Ingredients	(as stated)

3

4 For formulating the batters, all liquid ingredients,
5 including any aqueous dispersion, were added to a mixer
6 followed by sugar, flour and the remaining dry
7 ingredients. The added ingredients were all included in
8 the aqueous dispersion unless otherwise noted. Mixing
9 was continued for about one minute at high speed and the
10 resulting batter was pumped through a continuous mixer
11 (Oakes machine), divided into 439 gram portions and then
12 baked into loafs at 425°F for 5 minutes and 375°F for
13 about 31 minutes.

—

1 PROCEDURE FOR ADDITION OF ADDED INGREDIENT:

2 A - 6.56 parts of a hydrated gum dispersion were
3 included in the batter formulation.

4 B - 1.31 parts of the dry ingredients were added to
5 the batter and an additional 5.25 parts of water were
6 included in the batter formulation.

7 C - An additional 5.25 parts of water were added to
8 the batter formulation.

9 D - No additions were made to the batter formulation.

10 E - 6.56 parts of a hydrated gum and
11 protein-containing dispersion was included in the batter
12 formulation.

13 F - 6.56 parts of a fiber-free, hydrated gum and
14 protein-containing dispersion was added to the batter
15 formulation as was 0.24 parts of dry oat fiber.

16 G&H 6.56 parts of a hydrated gum, oat fiber and
17 protein-containing dispersion was included in batter
18 formulation.

19 I - 6.56 parts of a hydrated gum, fiber,
20 protein-containing dispersion was included in the batter
21 formulation. The fiber was powdered cellulose,
22 (Solka Floc 200) having an average fiber length of
23 35 microns and at least 95% insoluble fiber.

24 J - 6.56 parts of a hydrated gum, oat fiber, wheat
25 protein isolate-containing dispersion was incorporated
26 into the batter formulation. The wheat protein isolate
27 (LSI a product of Liberty Enterprises) was about 90%
28 protein. Lactose was added to the dispersion as a filler.

29 K - Same as J with substitution of vital wheat gluten
30 (about 80% protein) for the wheat protein isolate.

31 L - Same as J with substitution of egg albumen for
32 the wheat protein isolate.

33 M - 6.56 parts of a hydrated gum and oat
34 fiber-containing dispersion was incorporated into the
35 batter formulation.

- 14 -

1 N&O - Same as G.

2 P - Same as O with substitution of lambda carrageenan
3 (Viscarin GP 209 from Marine Colloids Division of FMC)
4 for xanthan gum.

5 Q - Same as O with substitution of locust bean gum
6 for all the xanthan gum.

7 R - Same as O with substitution of locust bean gum
8 for one-half the weight of xanthan gum.

9 S - 5.82 parts of a hydrated, protein-free, gum and
10 fiber-containing dispersion was added to the batter
11 formulation as was 0.74 parts of dry NFDM.

12 T - Gums were hydrated in 2.0 parts of water; NFDM
13 was hydrated in 2.0 parts of water; and fiber was
14 hydrated in 1.24 parts of water. The three dispersions
15 and the dextrose and dextrin were incorporated into the
16 batter formulation.

17

18 RESULTS (Organoleptic and appearance evaluations of
19 samples A to F and H to R compared to "G" standard at
20 days 1 and 6, respectively. Differences found on day 1
21 were also apparent on day 6, unless otherwise noted):

22

23 <u>Sample</u>	Day 1	Day 6
24		
25 G	Very good grain, texture	Slightly drier and less fresh
26 (standard -- most	appearance and mouthfeel;	than day 1; moisture and
27 preferred overall)	higher moistness than	freshness better than 6-day,
28	commercial, fat-containing	fat-containing pound cake.
29	(about 16% in batter)	
30	pound cake.	
31		
32 A	Much stickier, slightly	Slightly drier.
33	gummier, crumblier texture	
34		
35 B	Wooly texture; slightly more	Drier.
36	open grain; less moist.	
37		
38 C	Rubbery texture, decreased	Very dry and stale; not
39	loaf volume; not acceptable	acceptable.
40		

1	D	Low loaf volume, firm, dry, tough; not acceptable.	Very firm and dry; not acceptable.
2			
3			
4	E	Firmer texture, wooly, drier, very tight grain.	Not as moist, fairly fresh.
5			
6			
7	F	Close in texture and appearance, not quite as tender.	Same.
8			
9			
10	H	Slight tunnelling of grain, airier, poor eye appeal, sticky top, good moisture.	Some mold growth.
11			
12			
13			
14	I	Top of loaf slightly uneven and rougher, slightly drier.	Same.
15			
16			
17	J	Good eye appeal, slightly drier mouthfeel.	Drier texture and mouthfeel.
18			
19			
20	K	Less tough and gummy; good grain and texture.	Very good quality loaf
21			
22			
23	L	Slightly tougher, good eye appeal.	Slight off-flavor.
24			
25			
26	M	Good eye appeal, less firm, tighter grain, slightly less gummy.	Less tough mouthfeel.
27			
28			
29			
30	N	Spongy, some tunnelling, slightly gummy, dry mouthfeel, good grain.	Sticky top.
31			
32			
33			
34	O	Slightly pilly, spongy, less moist, slightly gummy.	Very sticky top.
35			
36			
37	P	Dry and crumbly; very short break.	Drys out mouth; hard to swallow.
38			
39			
40	Q	Very crumbly, short break, poor eye appeal.	Same.
41			
42			
43	R	Crumbly, short break, good eye appeal.	Same.
44			
45			
46	S	Poor eye appeal, collapsed, gummy, sticky top, wooly and dries out mouth.	Drier than control.
47			
48			
49			
50	T	Slightly less moist.	Close to standard, slightly pilly, slightly drier.
51			
52			

EXAMPLE 2

2 An aqueous dispersion was produced with the following
3 composition:

4	<u>Ingredient</u>	<u>(Weight %)</u>
5	Water	79.7
6	Xanthan gum	1.0
7	Guar gum	1.0
8	Dextrose	2.3
9	Oat fiber (88.4% insoluble fiber)	3.6
10	Milk solids non-fat (36% protein)	12.4

12 The dispersion was prepared by thoroughly blending
13 all the dry ingredients and then, using a Hobart A-200
14 mixer with a 20-quart bowl and a wire whip, mixing all of
15 the ingredients for 30 seconds on 2nd speed. This
16 pre-mix was then passed through a Gaulin laboratory
17 homogenizer (14M-8TA) at 1500 psi 1st stage and 500 psi
18 2nd stage. The resulting product was a smooth aqueous
19 dispersion with a moisture content of 81.5% and a pH of
20 6.7.

EXAMPLE 3

23 A loaf cake was prepared with the following batter
24 formulation:

25	<u>Ingredient</u>	<u>(Weight %)</u>
26	Aqueous dispersion (Example 2)	9.8
27	Emulsifiers	1.5
28	Sugars	28.5
29	Flour	24.1
30	Pregelatinized Starch	0.8
31	Leavening Agents	0.8
32	Flavors & Colors	0.6
33	Liquid Egg whites	19.6

1	Water	14.2
2	Preservative	0.1

3

4 The batter ingredients were mixed in a two-stage
5 continuous mixer and baked in loaf pans. The resulting
6 cake had excellent grain, texture and volume and was
7 commercially-acceptable after 7 days of ambient storage.
8 The moisture content of the freshly baked cakes was 42.9%
9 by weight.

10

11

EXAMPLE 4

12 A sweet dough was produced using conventional sponge
13 and dough processing and the following composition:

14	Sponge:	<u>(Weight %)</u>
15	Patent Flour	22.5
16	Emulsifier	0.2
17	Yeast Food	0.1
18	Fresh Yeast	2.2
19	Water	15.7

20 Dough:

21	Patent Flour	26.7
22	Sugar	9.2
23	Non-Fat Milk Solids	1.7
24	Egg Whites Solids	1.5
25	Flavors & Colors	1.3
26	Fresh Yeast	1.7
27	Water	3.9
28	Emulsifier	1.6
29	Aqueous Dispersion (Example 2)	11.7

30

31 The sponge ingredients were mixed together for 3
32 minutes on 2nd speed in a 12-quart bowl using a dough
33 hook and a Hobart A-200 mixer. The sponge was set to
34 ferment for one hour. To mix the dough all ingredients
35 were placed in the Hobart bowl and mixed for 30 seconds

1 on 1st speed and 10 minutes on 3rd speed until the dough
2 was fully developed. The dough was then divided,
3 rounded, molded into loaf-shaped form and proofed for
4 70 minutes at 90°F (32.2°C) and 80% R.H. The dough
5 loaves were baked for 23 minutes at 380°F (193.3°C).

6 The resulting loaves had excellent grain, texture and
7 volume and were commercially-acceptable after five days
8 of ambient storage.

9

10

EXAMPLE 5

11 Hamburger rolls were prepared using a conventional
12 dough formulation as a control and a variant dough
13 formulation wherein a portion of the water in the
14 conventional formulation was replaced by an equal amount
15 of water from a 10% solids aqueous dispersion (based on
16 weight of water), using the solids distribution of the
17 aqueous dispersion Example 2.

18		Control	Variant
19	<u>Ingredient</u>	<u>(weight %)</u>	<u>(weight %)</u>
20	Water	30.9	23.3
21	Aqueous Dispersion	-	8.2
22	Compressed Yeast	1.9	1.9
23	Bread Flour	53.7	52.7
24	Salt	0.8	0.7
25	Sugar	5.1	5.1
26	Non-Fat Milk Solids	2.5	2.5
27	Vegetable Shortening	5.1	5.1

28

29 The dough ingredients were mixed for 12 minutes and
30 had a dough temperature of 87°F (30.6°C) out of the
31 mixer. Floor time was 25 minutes.

32 The dough was divided into 2.25 ounce (63.8g) pieces
33 shaped into rolls and proofed for 20 minutes at 88°F
34 (31.1°C) and 80% relative humidity. The dough pieces
35 were baked at 440°F (226.7°C) until done. The variant

1 rolls were judged to have better volume, softer crumb,
2 darker crust color, and had a shorter bake time than the
3 control rolls.

4

5

EXAMPLE 6

6 Hamburger rolls were made using conventional sponge
7 and dough processing and the following formulation:

8 Sponge:	(Pounds)
9 High Protein Flour	280
10 Water	164
11 Yeast Food	1.5
12 Compressed Yeast	16
13 Emulsifier	2
14 Vitamins & Minerals	0.13
15 Dough:	
16 High Protein Flour	120
17 Water	44
18 High Fructose	48
19 Corn Syrup(42)	
20 Compressed Yeast	3
21 Salt	8
22 Mold Inhibitor	1
23 Dough Conditioner	2
24 Potassium Bromate	(3 tablets)
25 Aqueous Dispersion (Example 2)	20

26

27 The sponge and the dough ingredients were mixed for 1
28 minute at low speed and 7 minutes at high speed. The
29 dough was divided, proofed for about an hour at 103°F
30 (39.4°C) dry bulb and 95°F (35°C) wet bulb temperatures
31 and baked for 7.5 minutes at about 405°F (207.2°C). The
32 resulting rolls possessed a slightly lower volume, but
33 stayed softer longer and had a better flavor when

1 compared to conventional commercial rolls which usually
2 have a small amount of fat.

3

4

EXAMPLE 7

5 A danish dough was produced using a conventional
6 straight dough with a roll-in mixture for lamination
7 effect.

8 Dough:	<u>%</u>
9 Water	21.0
10 Flour	46.5
11 Sugar	10.4
12 Yeast, Fresh	2.9
13 Salt	0.7
14 Non-fat Milk Solids	3.1
15 Egg White Solids	.7
16 Emulsifier	1.7
17 Yeast Food	.1
18 Flavors	1.2
19 Aqueous Dispersion (Example 2)	<u>11.7</u>
20	100.0

21

22 All ingredients were mixed together for 5 minutes on
23 2nd speed in a 12-quart bowl using a dough hook on a
24 Hobart A-200 mixer. Dough temperature was 62°F (16.7°C)
25 after mixing. The dough was then sheeted.

26 Butter, margarine or a fat-free roll-in material
27 could be utilized for forming the laminated danish dough.

28 The roll-in mixture was applied to the sheeted dough
29 piece at a ratio of approximately 1 to 3 (roll-in/dough),
30 using typical danish roll-in, sheeting and folding
31 procedures. The finished dough piece has approximately
32 24 layers of dough/roll-in mix. The dough was sheeted to
33 a thickness of about $\frac{1}{4}$ inch (19 mm). The dough piece was
34 divided into smaller pieces about $1\frac{1}{2}$ inches (38 mm) by
35 16 inches (406 mm) and weighing 15 ounces (425g). The

- 21 -

1 dough piece was spiraled and then formed into a ring with
2 the ends overlapping and pressed together. The danish
3 ring was placed on a lightly greased baking pan. The
4 ring was proofed at 90°F (32.2°C), 80% R.H. for
5 60 minutes. The ring was baked at 380°F (193.3°C) for
6 25 minutes. The resulting ring exhibited flat, oval
7 grain structure with typical danish appearance and good
8 volume. The baked, danish ring has texture and flavor
9 and was commercially-acceptable after several days of
10 ambient storage.

11

12 EXAMPLE 8

13 Oatmeal-raisin cookies were prepared using the
14 following ingredients:

15	<u>Ingredient</u>	<u>(Weight %)</u>
16	Sugar	27.0
17	Aqueous Dispersion (Example 2)	8.1
18	Molasses	6.4
19	Salt	0.4
20	Egg Whites Solids	0.6
21	Milk Solids Non Fat	0.5
22	Maltodextrin	1.1
23	Leavening Agents	1.1
24	Spices	.2
25	Flavors	.3
26	Emulsifiers	.1
27	Water	5.9
28	Oats	16.1
29	Flour	18.8
30	Raisins	<u>13.4</u>
31		100.0

32

33 The ingredients were mixed together for 3 minutes on
34 1st speed in a 12-quart bowl using a flat paddle on a
35 Hobart A-200 mixer. The resulting dough was divided into

- 22 -

1 approximately one-half ounce pieces and placed on a
2 cookie baking pan. The cookies were baked for 9 minutes
3 in a 400°F (204.4°C) oven. The resulting cookies were
4 soft and chewy and are commercially acceptable after
5 several days of ambient storage.

6

7

EXAMPLE 9

8 A bread was prepared using the following ingredients:

9 <u>Ingredient</u>	<u>(Weight %)</u>
10 Water	14.1
11 Flour	38.3
12 Yeast	1.0
13 Emulsifier	.7
14 Yeast Food	.2
15 Fiber, Wheat	3.4
16 Aqueous Dispersion (Example 2)	35.2
17 Vital Wheat Gluten	4.2
18 Sugar	1.7
19 Vinegar	.4
20 Salt	<u>.8</u>
21	100.0

22

23 All ingredients were mixed together in a 20-quart
24 bowl with dough hook on a Hobart A-200 mixer, one minute
25 on 1st speed, 10 minutes on 2nd speed. The dough
26 fermented for 1 hour, then was divided into 26.25 ounce
27 dough pieces and rounded with floor time (resting time)
28 of 10 minutes. The rounded pieces were then moulded into
29 typical bread loaves and deposited into baking pans. The
30 loaves were proofed at 85% R.H. and 95°F (35°C) for
31 70 minutes. The loaves were then baked at 425°F
32 (218.3°C) for 22 minutes and removed from the pan for
33 cooling. The loaves exhibit excellent volume, cell

1 structure and soft texture. The loaves were commercially
2 acceptable after five days.

3

4

EXAMPLE 10

5 A high-fiber bread was made in accordance with
6 Example 9 with the substitution of an aqueous dispersion
7 having a 20% solids content consisting of 1 part xanthan,
8 1 part guar, 8 parts milk solids non-fat and 10 parts oat
9 fiber for the aqueous dispersion of Example 2. For such
10 products the amount of hydrated, insoluble fiber added to
11 the dough from the aqueous dispersion is relatively
12 high, here 8.1 parts per 100 parts of flour, and will
13 typically be on the order of 6 to 12 parts hydrated,
14 insoluble fiber per 100 parts of flour. Additional
15 insoluble fiber may be added to the dough as a dry
16 ingredient, typically at a level of from 2 to 10 parts,
17 preferably 2 to 6 parts, per 100 parts of flour. A
18 fat-free, high-fiber bread made in accordance with this
19 example has good taste, texture and consumer acceptance.

20

21

EXAMPLE 11

22 A fat-free, high-ratio cake was prepared with
23 non-chlorinated flour. Typically non-chlorinated flour
24 dictates that the sugar level in the cake batter be less
25 than the flour level (i.e., low-ratio). Chlorinated
26 flours enable the production of high-ratio cakes;
27 however, the use of chlorinated flour is restricted by
28 some governmental agencies.

<u>Ingredient</u>	<u>(Weight %)</u>
29 Sugars	23.6
30 Emulsifier	0.8
31 Nonfat dry milk	2.7
32 Flour, non-chlorinated	19.5
33 Maltodextrin	2.3
34 Starches	6.5

35

- 24 -

1	Aqueous Dispersion (Example 2)	6.8
2	Water	17.8
3	Egg Whites	18.0
4	Flavors	0.7
5	Salt	0.3
6	Leavening Agents	0.9
7	Preservative	0.1
8	Color	< 0.1

9

10 Mix all of the ingredients until a smooth batter is
11 formed. Run the batter through a continuous mixer to
12 obtain a specific gravity of 0.925. The batter was
13 distributed to loaf pans at 15.5 ounces (440g) per pan
14 and baked at 380°F (193.3°C) for about 40 minutes until
15 golden brown. The resulting cake had good volume, grain
16 and color as compared to conventional, high-ratio cakes
17 made with chlorinated flour and were preferred to
18 conventional low-ratio cake made with non-chlorinated
19 flour.

20

21

EXAMPLE 12

22 A low-ratio cake was produced with non-chlorinated
23 flour. The cake batter formulation is typical of
24 European, low-ratio cakes with the aqueous dispersion of
25 this invention included as an addition.

26	<u>Ingredient</u>	<u>(Weight %)</u>
27	Whole eggs	15.4
28	Sugar	18.2
29	Flour, nonchlorinated	30.3
30	Butter	15.2
31	Leavening Agents	1.2
32	Milk	15.2
33	Aqueous Dispersion	4.5

34

1 The butter and sugar were creamed together at room
2 temperature and then heat was applied to produce a light
3 and airy texture. The aqueous dispersion was warmed and
4 then added to the butter-sugar blend while mixing was
5 continued. Thereafter the eggs were warmed and slowly
6 added. The flour was presifted, added to the above mix
7 together with the leavening agents, and mixed just until
8 these ingredients are incorporated. Milk is warmed and
9 mixed in until a smooth batter is formed. Overmixing is
10 avoided. The batter was distributed into loaf pans and
11 baked at 360°F (182.2°C) for about 28 to 30 minutes until
12 golden brown. The resulting cake had good volume, color
13 and grain. The cake was as firm but less dry than the
14 conventional low-ratio cake and was preferred thereto.
15

16 EXAMPLE 13

17 A fat-free, low-ratio cake was produced with
18 non-chlorinated flour. The cake batter formulation is
19 free of butter, whole eggs and whole milk but contains
20 the aqueous dispersion of this invention.

21 <u>Ingredient</u>	22 <u>(Weight %)</u>
23 Sugar	19.2
24 Flour, non-chlorinated	32.1
25 Leavening Agents	1.3
26 Aqueous Dispersion (Example 2)	14.4
27 Egg Whites	14.4
28 Nonfat dry milk	2.5
29 Water	16.1

30 The aqueous dispersion was warmed and then creamed
31 together with the sugar; thereafter, warmed egg whites
32 were blended in. The flour was presifted and mixed into
33 the blend along with leavening agents. The nonfat dry
34 milk was reconstituted in warmed water, added to the
35 above mixture and mixed until a smooth batter is formed.

1 The batter was distributed into loaf pans and baked at
2 360°F (182.2°C) for about 25 to 28 minutes until golden
3 brown. The resulting cake was an acceptable fat-free
4 cake having an acceptable grain and a better volume than
5 conventional fat-containing low-ratio cakes.

CLAIMS

- 1
2 1. A method for preparing a baked good comprising
3 the steps of hydrating one or more polysaccharide
4 hydrocolloids, incorporating the hydrated hydrocolloids
5 into a flour-containing mixture selected from the group
6 consisting of doughs and batters, wherein the level of
7 addition of the polysaccharide hydrocolloid is from 0.1
8 to 4.0 parts hydrocolloid (dry basis) per 100 parts
9 flour, and thereafter, baking the hydrocolloid-containing
10 batter or dough to produce a baked good.
- 11 2. The method of claim 1 wherein the level of
12 addition is from about 0.25 to 2.0.
- 13 3. The method of claim 1 wherein the hydrated
14 hydrocolloids are added in the form of an aqueous
15 dispersion.
- 16 4. The method of claim 4 wherein the aqueous
17 dispersion has a viscosity of at least 4.0 Brookfield
18 units.
- 19 5. The baked good produced by the method of claim 1.
- 20 6. The baked good of claim 5 wherein the baked good
21 is essentially fat-free.
- 22 7. The baked good of claim 5 wherein the
23 polysaccharide hydrocolloid consists of non-gelling gums.
- 24 8. The baked good of claim 5 wherein the
25 polysaccharide hydrocolloid is comprised of anionic gum
26 and galactomannan gum.
- 27 9. The baked good of claim 8 wherein the
28 polysaccharide hydrocolloid consists of anionic gum and
29 galactomannan gum at a weight ratio of from 1:4 to 4:1.
- 30 10. The baked good of claim 8 wherein the anionic
31 gum contains a carboxylic acid group in its molecular
32 structure.
- 33 11. The baked good of claim 10 wherein the anionic
34 gum is xanthan gum.

1 12. The baked good of claim 10 or 11 wherein the
2 galactomannan gum is guar gum.

3 13. The baked good of claim 5, 6 or 8 wherein the
4 flour-containing mixture further contains added hydrated
5 insoluble fiber.

6 14. The baked good of claim 13 wherein the insoluble
7 fiber is present at a level of from 0.1 to 5.0 parts
8 insoluble fiber per 100 parts flour.

9 15. The baked good of claim 14 wherein the fiber
10 level is from 0.1 to 2 parts per 100 parts of flour.

11 16. The baked good of claim 13 wherein the hydrated
12 insoluble fiber is contained in an aqueous dispersion
13 which is added to the flour-containing mixture.

14 17. The baked good of claim 13 wherein the weight
15 ratio of polysaccharide hydrocolloid to fiber is from
16 1:0.8-6.

17 18. The baked good of claim 13 wherein the fiber is
18 cereal grain fiber.

19 19. The baked good of claim 18 wherein the fiber is
20 selected from the group consisting of oat fiber, soy
21 fiber, wheat fiber and combinations thereof.

22 20. The baked good of claim 5, 6 or 8 wherein the
23 flour-containing mixture further contains added hydrated
24 protein at a level of from 0.1 to 8 parts per 100 parts
25 of flour.

26 21. The baked good of claim 20 wherein the hydrated
27 protein is contained in an aqueous dispersion which is
28 added to the flour-containing mixture.

29 22. The baked good of claim 20 wherein the weight
30 ratio of polysaccharide hydrocolloid to protein is from
31 1:1.1-4.5.

32 23. The baked good of claim 20 wherein the protein
33 is selected from the group consisting of milk protein,
34 milk protein fractions, casein, wheat gluten, egg
35 albumen, wheat protein and combinations thereof.

1 24. The baked good of claim 14 wherein the
2 flour-containing mixture further contains added hydrated
3 protein at a level of from 0.1 to 8 parts per 100 parts
4 of flour.

5 25. The baked good of claim 13 wherein both the
6 hydrated protein and the hydrated insoluble fiber are
7 contained in a polysaccharide hydrocolloid-containing the
8 aqueous dispersion which is added to the flour-containing
9 mixture.

10 26. The baked good of claim 25 wherein the weight
11 ratio of polysaccharide hydrocolloid to insoluble fiber
12 to protein is 1:0.8-6:1.1-4.5.

13 27. The baked good of claim 26 wherein the weight
14 ratio is 1:0.8-3.5:1.5-3.5.

15 28. The baked good of claim 27 wherein the weight
16 ratio is 1:1.5-2.0:2.0-3.0.

17 29. The baked good of claim 5 wherein the
18 flour-containing mixture further contains hydrated
19 insoluble fiber and hydrated protein material a weight
20 ratio of polysaccharide hydrocolloid to insoluble fiber
21 to protein of 1:0.8-6:1.1-4.5.

22 30. The baked good of claim 29 wherein the baked
23 good is essentially fat-free.

24 31. The baked good of claim 5, 6, 29 or 30 wherein
25 the baked good is a cake produced from a batter.

26 32. The cake of claim 31 wherein the flour in the
27 cake batter consists of non-chlorinated flour.

28 33. The baked good of claim 4, 5, 6, 29 or 30
29 wherein the baked good is a cookie.

30 34. The baked good of claim 4, 5, 6, 29 or 30
31 wherein the baked good is a bread or roll.

32 35. The baked good of claim 4, 5, 6, 29 or 30
33 wherein the baked good is a sweet good produced from a
34 dough.

1 36. The baked good of claim 4, 5, 6, 29 or 30
2 wherein the baked good is a laminated sweet good produced
3 from a dough.

INTERNATIONAL SEARCH REPORT

International Application No PCT/US90/03407

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ³ According to International Patent Classification (IPC) or to both National Classification and IPC IPC (5): A21D 8/00; A21D 15/00; A21D 15/08 U.S. Cl.: 426/496, 506, 549, 556, 653, 656, 658, 804						
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched ⁴</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 20%; border: 1px solid black;">Classification System</th> <th style="border: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="border: 1px solid black; text-align: center;">U.S.</td> <td style="border: 1px solid black; text-align: center;">426/496, 506, 549, 556, 653, 656, 658, 804</td> </tr> </table> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵ </div>			Classification System	Classification Symbols	U.S.	426/496, 506, 549, 556, 653, 656, 658, 804
Classification System	Classification Symbols					
U.S.	426/496, 506, 549, 556, 653, 656, 658, 804					
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴						
Category ⁹	Citation of Document, ¹⁴ with indication, where appropriate, of the relevant passages ¹¹	Relevant to Claim No. ¹⁵				
A	US, A, 3,676,150 (GLICKSMAN et al.) 11 July 1972 See the abstract and Claims 1-4.	1-36				
A	US, A, 4,109,018 (THOMPSON) 22 August 1978 See the abstract, col. 2, lines 41-55 col. 5, lines 1-51 and Claims 1.	1-36				
A	US, A, 4,219,580 (TORRES) 26 August 1980 See the abstract	1-36				
X Y	US, A, 4,424,237 (WITTMAN, III) 03 January 1984 See the abstract, col. 1, lines 12-60, and Claims 1-6	1-7, 31, 32, 35 8-12, 33, 34, 36				
A	US, A, 4,431,681 (HEGEDUS et al.) 14 February 1984 See the abstract	1-36				
Y	US, A, 4,451,490 (SILVERMAN et al.) 29 May 1984 See the abstract and Claims 1 and 5.	8-12, 35, 36				
Y	US, A, 4,774,099 (FEENEY et al.) 27 September 1988 See col. 6, lines 17-26 and Claim 22	13-19, 25-36				
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>¹⁶ Special categories of cited documents: ¹⁶</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>						
IV. CERTIFICATION						
Date of the Actual Completion of the International Search ⁷ <div style="text-align: center; font-size: 1.2em;">13 September 1990</div>		Date of Mailing of this International Search Report ⁸ <div style="text-align: center; font-size: 1.5em; font-weight: bold;">26 FEB 1991</div>				
International Searching Authority ¹ <div style="text-align: center; font-weight: bold;">ISA/US</div>		Signature of Authorized Officer ¹⁰ <div style="text-align: center;"> Evan Federman </div>				

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

Y,P	US, A, 4,847,108 (INOUE et al.) 11 July 1989 See the abstract and col. 2, lines 36-51.	20-24, 25-30
A,P	US, A, 4,865,863 (PROSISE et al.) 12 September 1989 See the abstract and col. 1, lines 36-44.	1-36
A	DT, A, 3,504,596 (DULSEN H J) 14 August 1986 See the abstract.	1-36

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE¹

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out¹, specifically:

3. ☐ Claim numbers because they are dependent claims not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING²

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.